

Hydraulic System for a Slide —

The present invention relates to a multipart male mold plate for a form tool for injection-molding of molded articles according to the preamble of claim 1.

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Such male mold plates are used in injection-molding form tools as disclosed for example in EP 0 647 514 and comprise a base plate and a stripper plate having a slide, wherein the slide supports a plurality of separate male mold cones. In opening such form tool the multipart male mold plate is retracted in order to expose or uncover the  
10 freshly injected molded blanks, in particular preforms, i.e. to pull them from the female mold or die. There is provided a removal device between the die and the male mold plates to extract the preforms, for example as described in EP 0 907 488. To remove the preforms, the stripper plate, which is provided with a slide, is separated from the base plate and the slide is guided along an inclined drag element. By this means the  
15 various male mold cones are opened and the preforms can be transferred to the removal device. For this, pressurised air is used, by means of which the preforms are ejected from the opened male mold cones. The length of the preforms, generally 8 to 12 cm, permits insertion of the preforms in the removal device before the various male mold cones are completely open. This ensures a secure transfer of the preforms from  
20 the male mold cones to the removal device.

However in removing particularly short preforms, i.e. preforms with a length of about 3 to 5 cm, the secure intake or capture of the preforms in the respective removal sleeves of the removal device is not ensured, because the removal sleeves of the removal  
25 device cannot be brought close enough to the external extremity of the preforms, or because the separable male mold cone has a relatively long opening distance, for example about 5 cm or more.

It is therefore an object of the present invention to provide a device by means of which  
30 relatively short preforms can be removed in a secure manner.

This object is achieved according to the invention by means of a male mold plate having the features of claim 1, and in particular by means of a male mold plate whose slide is actuatable by means of a hydraulic drive.

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With the male mold plate according to the invention, the freshly injected preforms are retained or held back until they reach a removal sleeve of the removal device and are safely guided therein. Only then are the male mold cones completely opened according to the invention with the aid of a hydraulic drive, instead of with an inclined drag  
5 element, and the preforms can be securely sucked into the removal sleeves. Obviously, the opening of the male mold cones is started as early as possible in order to keep the cycle time of the tool as short as possible.

The advantages of such a male mold plate are immediately apparent to the person  
10 skilled in the art and are to be seen in particular in the shortening of the opening distance necessary for opening the male mold cone. Other advantages are to be seen in that pressurised air previously used is no longer required for removing the preforms and, as a consequence, the contamination of the preforms caused by this pressurised air can be avoided.

15 Other advantageous embodiments of the present invention are disclosed by the features of the dependent claims.

In a first preferred embodiment the hydraulic drive is attached or secured to the slide  
20 and rests against the stripper plate. Obviously the hydraulic drive can be secured also to the stripper plate and the slide can be actuated from there.

In a preferred embodiment the hydraulic drive serves to completely open the male mold cones and there is provided a pull-back spring to again close the open male mold  
25 cones. Naturally the expert can open the male mold cones by means of a spring force and can close them by means of the hydraulic drive. Advantageously the inclined drag element is provided with a step or swell at a location between a separation position and an extraction position, which displaces the slide by a detachment stroke. By means of this detachment stroke of less than 1 mm the preform is simply detached from the  
30 respective male mold cone, to avoid that the preform remains stuck to one half of the male mold cones when these are opened.

In the following the invention is described in more detail by means of an exemplary embodiment and with the help of the Figures which show:

Fig.1 a male mold plate of the known art in the extraction position,

Fig.2 a male mold plate according to the invention in the extraction position.

Figure 1 shows a multipart male mold plate 1 of a known type, which incorporates a  
 5 base plate 2, a stripper plate 3 and a slide 4. This slide 4 bears several separable male  
 mold cones 5, 5'. When opening the form tool the complete male mold plate is retracted  
 for extracting the preforms 6 from the die (not shown). In a further cycle stage the  
 stripper plate 3 is brought from a separation position A into an extraction position B.  
 Thereby the slide 4 moves along an inclined drag element 7 which is securely attached  
 10 to the base plate 2, which drag element 7 defines an opening distance s. This  
 completely opens the male mold cones 5. The completely opened male mold cones are  
 indicated by reference numeral 5'. Figure 1 shows clearly that in opening the male mold  
 cones 5, the individual preforms 6 are no longer securely held and in the extraction  
 position B of the male mold cones 5' the preforms can cant and therefore can no longer  
 15 be extracted. To effect the extraction of the preforms 6, pressurised air 11 is introduced  
 into the open male mold cone 5' of this tool of the known art. This pressurised air  
 generally carries dirt or oil particles and contaminates the freshly injected preforms. In  
 addition, Figure 1 shows clearly that the male mold cones 5' in the extraction position B  
 and the removal device 8, respectively its removal plate 9 and removal sleeve 10,  
 20 cannot be brought closer to each other, since in the case of a successful extraction of  
 the preform, the latter would again be caught up by the closing male mold cone 5'  
 during the retraction of the stripper plate 3 and would thus be pulled out from the  
 removal sleeve 10.

25 Figure 2 shows an arrangement of the male mold plate 1 according to the invention,  
 again with separable male mold cones 5 in their separation position A, as well as an  
 opened male mold cone 5 in the extraction position B. The base plate 2 has a laterally  
 arranged inclined drag element 7 which has only at position C a step or swell to cause a  
 detachment stroke h. By means of this detachment stroke h the preforms are merely  
 30 loosened or detached from the male mold cones to ensure that the preforms, during the  
 complete opening of the male mold cones 5, do not remain stuck to the latter. The slide  
 4 is movably attached to the stripper plate 3, which slide supports the separable male  
 mold cones 5. In the zone of the extraction position B the male mold cone 5 is opened  
 by means of a hydraulic drive 12. In this embodiment the hydraulic drive 12 is secured  
 35 to the slide 4 and rests against the stripper plate 3.

Figure 2 shows clearly that the opening distance  $s$  can be shortened significantly by using a hydraulic drive and thus the preforms 6 can be brought into the extraction sleeves 10 of the extraction device 8, before the male mold cones 5 are completely open. Furthermore, this shortened opening distance allows to bring the extraction plate 9 of the extraction device 8, and the extraction sleeve 10, closer to the completely open male mold cones 5' by a distance  $d$ . This ensures a secure removal of extremely short preforms. Moreover it is possible to dispense with the use of pressurised air for the transfer of preforms, thereby avoiding the associated contamination. Advantageously in a subsequent cycle stage, the male mold cones 5' are again brought into a closing position by means of a pull-back spring engaged at the slide 4.